Agricultural Uses of "Burnt" Lime -
Why We Should Take Another Look.

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"Burnt" lime, {Calcium Hydroxide(Hydrated lime, Slaked lime, Dead lime), or Calcium Oxide(Caustic lime, Hot lime, Quick lime, Live lime)}, has been used worldwide, by almost all civilizations in agriculture for centuries.

In recent times, Government bodies have recommended the use of pulverized limestone as a replacement for "burnt" lime, for agricultural pH control and the management of soils. It is mistakenly believed that the less expensive limestone is an equal replacement for "burnt" lime, if used at an application rate of twice the requirement of "burned" lime.

It is true that if one reacts lime and limestone in hydrochloric acid, it will take twice the amount of limestone to neutralize an equal amount of acid.

However, this is not what happens in the field.

Limestone is an almost inert chemical compound, but will react with acid soils to provide neutralization. This is beneficial to the plants growing in the soil, as a proper pH of the soil is required to make nutrients available to the plants. Proper soil pH also prevents the absorption of metals toxic to the plants. Limestone also supplies calcium and magnesium elements to the plants, needed by all living things for healthy growth.

Reactions involving neutralization of soil acids, which in many cases are caused by the deposition of acid rain, often result in high sulphur compounds in the soil. These sulfates form insoluble compounds on the surface of the limestone particles, preventing utilization of the entire limestone particle. This insoluble coating reaction practically stops further neutralization and contribution of the limestone elements to plant growth.

As you can see, for limestone to be useful to the plants, it must be ground to a very small particle size. This is an expensive process, and is not generally accomplished in limestone preparation and use.

"Burnt" lime is a very active chemical, and when reacted with water, naturally forms extremely small particles, having tremendous surface areas, not obtainable by grinding.

As an active chemical, "burnt" lime reacts immediately with acids to control pH and prevent absorption of heavy metals by the plants.

"Burnt" lime also reacts with soil particles to agglomerate the clays by flocculation - changing the heavy clay soils into silt and sand size particles. This process improves soil structure by

eliminating hard pan soils; creating soils with proper aeration and allowing deeper root growth. This results in higher yields, less fertilizer requirements, and better management of soil moisture levels.

This change of particle size - from clay particles to silt / sand size particles also helps prevent erosion and loss of the soil due to high winds and excessive rainfall. This agglomeration of the particles , making them larger and less soluble, is effective in helping to prevent loss of top soils.

This can easily be demonstrated by adding a small amount of "burnt" lime to a mud puddle. Immediately, one can see the water clear up, as the lime reacts with the very fine clay particles, agglomerating them and causing them to settle out, leaving the water clear. In the field, this agglomeration of clay particles prevents the erosion of top soils.

The use of "burnt" lime may also provide a sterilizing effect on the surface of the soil particles, as the pH of lime is 12.4. At this pH level, many undesirable organisms, virus, and fungi will be unable to survive. This treatment will result in partial control of organisms detrimental to a crop. However, the lime will then react with the soil pore water, and be controlled to neutral pH level. Only by applying lime at a rate that exceeds the "Buffering Capacity" of the soil does one raise the pH of the soil to levels that inhibit plant growth.

The application rate, of course, depends on the soil. Sandy soils have a much lower "Buffering Capacity" than do heavy clay soils.

Benefits of using "burnt lime" include:

* Quick pH control

* Better crop yields

* Control of disease and insects

* Control of erosion from rain and wind, due to larger soil particle size

Our forefathers "burned" limestone by stacking alternate layers of fuel (wood or coal) and limestone into a pile or into a pit and igniting the fuel. As the fuel is burned, producing intense heat, the limestone($CaCO_3$), gives up its Carbon Dioxide(CO_2) , leaving the chemical, Calcium Oxide(CaO).

$$\underset{\text{Limestone}}{CaCO_3} + \text{Heat} = \underset{\text{Calcium Oxide}}{CaO\ (\text{solid})} + \underset{\text{Carbon dioxide}}{CO_2\ (\text{gas})}$$

The remaining material, Calcium Oxide, is called quicklime, because when water is mixed with the Oxide, it begins to swell and move, (as if alive, to quicken), produces heat, and falls apart into a fine white powder. We call this powder Calcium Hydroxide or hydrated lime. The chemical equations are:

CaO + Water	=	$Ca(OH)_2$	+	Heat
Quicklime		Hydrated lime		

(While pulverized quicklime can be applied to the soil, it quickly reacts with water in the soil and air to form hydrated lime.)

Today, we manufacture "burnt" lime in industrial furnaces called kilns. Limestone is mined, crushed and fed into the kiln, and heated for a long period of time. The process is called calcining, and is just a modern efficient method of converting the inert limestone to the active "burnt" lime.

Quicklime is supplied in 90# paper sacks, 1 ton "super sacks", or in bulk truckload quantities.

For most purposes, the oxide is then reacted with water to form the hydroxide in a device called a hydrator or slaker. Hydrated lime is supplied as a slurry; as a dry powder, in 50# paper sacks or 1 ton "super sacks"; or in bulk truckload quantities.

"Burnt" lime in the United States is the fourth largest chemical used. In 1995, industry used over 22 Million short tons of this versatile chemical.

The immediate response that "burnt" lime provides in controlling pH; the sterilizing effect if provides; and maybe even most important - the control of erosion due to agglomeration and flocculation of clay particles needs to be recognized by Federal and State Agricultural officials and farmers.

"Burnt" lime use in agriculture deserves a re-evaluation.

Its use will help save our valuable top soils, provide better crop yields with less use of pesticides and fertilizers, and help prevent silting of our waterways and reservoirs.

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